

Section I: The Background of This Response

1. In an earlier communication the Examiner referred to Lefe's US patent number 6,456,744 (Method and apparatus for video compression using sequential frame cellular automata transforms) while rejecting the claims.
2. Applicant submitted the arguments to establish the fact that the rejection is not justified in February 2008.
3. In the referenced communication on 9/19/2008, the examiner refers to (2) and states:

"With respect to the rejection(s) of claim(s), applicant arguments have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made."

The new ground(s) of rejection are based on US patent no. 6456744 (on video compression) and US patent no. 5677956 (on encryption). The applicant's response to these new grounds of rejections is given below to establish the fact that the rational for rejection is not justified.

Section II: Response to examiner's point numbers 3, 5, and 6 in respect of specification objection and claim rejection

Point No. 3: The specification filed November 30, 2003 is objected to as failing proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d) (1) and MPEP 608.01(o). Correction of the following is required : the term "computer readable media" in claims 11-20 doesn't have antecedent basis in the specification.

Applicant's Response: This observation is incorrect in view of the following logical reasoning that establishes the antecedent basis in the specification for the claims 11-20.

1. Under the heading 'Technical Field' of page 1 of the patent application, it has been specified that this invention "relates to efficient and secured storage and transmission of digital data files and, more particularly, to a system and method that implements encryption and compression operations as a fully integrated single operation using a single computing model based on Cellular Automata".
2. Operations like Compression and Encryption, in the current internet age, are invariably implemented on the data stored and transmitted from one computer to other through a digital network.
3. Hence 'storage and transmission of digital data files', as noted in the specification, invariably relates to computer readable media claimed in 11- 20 of the application.

Point No. 5: "Claim 11 is directed to logic encoded in media. The examiner respectfully asserts that the claimed subject matter does not fall within the statutory classes listed in 35 USC 101. Claim 11 directed a computer readable media/carrier wave that includes data signals. A signal does not fall within one of the statutory classes of 101 claim. Claims 11 are rejected as being directed to data signal. Claim 12-20 do not cure the deficiency of USC 101 rejection and are rejected on the same rational."

Applicant's Response: The background of the use of the terms and language described in the Claims is explained respectfully by the applicant. The rational for rejection of the claim 11 and also 12-20 is not valid as explained below.

1. The term "Signal" here refers to digital signal (logic level 1 and 0 only) that holds good both for computer readable media or carrier of digital data (binary bit 1 and 0) in the current digital world. Hence the terms digital signal and digital data are synonymous. This nomenclature of digital data/"signal" has become a de-facto standard in the digital media/world that extensively employs both Encryption and Compression operations.
2. Hence there exists no rational regarding rejection of the claim on the basis of "A

signal does not fall within one of the statutory classes of 101 claim”.

Point No. 6: “Claim 21 ----- rejected under 35 USC 101 because the claimed invention **directed to non-statutory subject matter**. Claim 21 is a system claim without any structural component and ----- Claim 21 **does not provide any functional interrelationship to any software and hardware structural components to provide certain function that is processed by a computer**. Claims 22-30 ----- same rational.”

Applicant's Response: The arguments for rejection of the claims 21 and also 22-30 is invalid because of the following reasons.

1. On the basis of explanation noted in the response to Point no. 5, in respect of digital signal and digital data, the question of non-statutory subject matter does not arise in the claims 21 and 22-30. The claims are relevant to title of the patent application dealing with the system of ENCOMPRESSION (ENcryption and COMPRESSION) as an integrated operation on digital data/signal in computer readable media/carrier.
2. The objection noted in bold letters under point no. 6 is not valid because - each of the functional hardware blocks used in EnCompression and D'enCompression modules noted in the claims 21-30 (MACA, PCA, Codebook storing vectors, codebook search engine employing MACA (Multiple Attractor CA), Encoder (implementing EnCompression), Decoder (D'enCompression) etc.) are explicitly noted in the circuit design of Fig. 1(b) and 1(c) and also in Fig 6 of the patent application. The explanation and function of this hardware design have been detailed under “Description of Example Embodiments” reported in pages 6-17 of the Patent Application no.10/749,024. This hardwired structure is driven by a (PCA) program stored in EnCompression Program memory (Item 28 in Fig 1(b)) for EnCompression and Codebook Memory (Item 72 in Fig. 1 (c) for D'enCompression. **This common hardware design used both for Compression and Encryption** is not driven by any conventional hardware and software processed by a computer. It is driven, as elaborated in Section VI, by (PCA) program. Consequently, examiner's rejection based on “**Claim 21 does not provide any functional interrelationship to any software and hardware structural components to provide certain function that is processed by a computer**” is not justified. Further explanation of (PCA) program (as elaborated in the patent application) driving the hardware is provided under point no. (2) and (3) in Section VI.

Section III: Fundamental difference of the Patent Application 10/749024 with US Patents 6456744 and 5677956

The applicant explains at a high level the difference between the two patents to give the examiner a broad level historical understanding of Cellular Automata (CA) transform/evolution.

CA is a dynamical system discrete in space and time. Its evolution is specified by “**CA transform**” conventionally specified by the CA rules employed in different cells. Thus the term CA Transform means CA Rule Vector that specifies the rules employed in different cells.

Hence the **CA transform is a general concept** available in the literature since mid 1950's while J von Neumann first proposed the concept of CA and subsequently used by many researchers in different disciplines. Application of CA in any discipline utilizes CA evolution associated with the corresponding CA transform. Hence no patent can claim that CA transforms are its invention and the subsequent patents are rejected only because there exists a prior patent that utilizes CA. The question of rejection only arises if the same CA transforms are employed in an identical manner.

If the examiner claims that “CA transform” is an unique concept and falls under the Patents 6456744 and 5677956, the applicant (who is an authority in the field of Cellular Automata) would provide sufficient proof from several academic papers and books using or defining the term “CA Transform/Evolution” ages before the filing of the patents 6456744 and 5677956.

1. The US patents 6546744 and 5677956 and the patent application 10/749024 employ CA transforms. Use of CA Transforms is a must in any CA application in any discipline. However, the method of employing specific CA transform in the application 10/749024 is totally different from those in US patents 6546744 or 5677956. As mentioned earlier, only identical CA transforms can be defended by a patent and not the CA Transform concept.
2. Both the patents 6546744 and 5677956 employ traditional mathematics employing transforms, transform coefficients, identification of various orthogonal and non-orthogonal transforms based on CA evolution. On the other hand the application 10/749024 does not employ such a conventional mathematical framework. Rather, it employs CA transform as a pattern matching tool (in code book search, matching an input with CA state as it evolves).

Hence, there is fundamental difference in the basic approach between the applicant's patent and patents 6546744 and 5677956. The applicant could recommend names and contact information of scholars in this field with whom the examiner can consult for clarification in this matter.

Section IV: Difference between "Compression Task" in the Integrated Operation ENCOMPRESS (Encryption + COMPRESSION) reported in the Patent Application 10/749024 and the US Patent No. 6546744

1. Any elementary book on Compression specifies two major schemes for compression – Transform Coding and Vector Quantization. **While US patent 6546744 employs Transform coding (specifically CA transform coding), the application 10/749024 employs Vector Quantization scheme.** In this scheme, data elements are stored in a vector table (in the memory) and matched/searched through different schemes. The Patent Application 10/749024 proposes application of CA to match/search the Vector Table stored in memory. The specific type of CA employed for this search is referred to as MACA (Multiple Attractor CA) illustrated in Fig. 4 and 5 of the patent application. MACA was first proposed by the applicant in his book entitled "Additive Cellular Automata: Theory and Applications" published by Wiley-IEEE Computer Society Press in July 1997, ISBN 978-0-8186-7717-5.
2. In any Transform Coding scheme for data compression, the transform coefficients are stored in memory after quantization (as done in the US Patent 6456744). The Vector Quantization scheme, on the other hand, employs a totally different approach. In line with such an approach the Patent Application 10/749024 stores the data elements in a Vector Table (stored in memory) and searches for the nearest match of an input data element in the vector table through pattern matching employing CA evolution/transform.
3. While in US patent 6456744 employs communication link to transmit quantized transform coefficients, the application 10/749024 transmits the index of an element in the vector table on matching/searching the element through the use of Multiple Attractor CA (MACA).
4. For Decompression, while the US patent 6456744 retrieves the original data through reverse CA transforms and the quantized coefficients transmitted as compressed data, the application 10/749024 retrieves the original data from the vector table stored at the receiving end by utilizing the table indices transmitted as compressed data.

Hence, there is fundamental difference in "Compression Operation" between the applicant's patent and patents 6546744. The applicant could recommend names and contact information of scholars in this field with whom the examiner can consult for clarification in this matter.

Section V: Difference Between "Encryption Task" in the Integrated Operation ENCOMPRESS (Encryption + COMPRESSION) Reported in the Application 10/749024 and the US Patent No. 5677956

1. Any conventional scheme employing CA for encryption will utilize different types of CA transforms based on established analytical framework. The US patent 5677956 utilizes

traditional mathematical tools employing a series of CAs (CA bases) to generate the associated coefficients as cipher text to encrypt an input plain text. The selection of CA bases (based on encryption key) is made in such a way that at the decryption stage while regenerating the original plain text, the residual error is zero (refer to the text under the heading "TYPES OF CA TRANSFORMS" in Lafe's Patent 5677956). By contrast, the application 10/749024, as noted in Fig. 7 of the patent application, employs three different types of CAs (linear, affine, and non-affine in four different stages). Each of these CAs is a reversible CA (illustrated in Fig. 2 and 3 of patent application) chosen based on input key unlike 5677956. CAs are selected in such a way that minimal time is elapsed while retrieving the original plain text. This selection process of CAs is again guided by matching of input data with the states generated during evolution of selected CAs. For the Patent Application 10/749024, the input data for encryption is the set of table indices derived on execution of compression within the integrated operation of ENCOMPRESSION. Hence even though both the Patent No. 5677956 and Patent Application 10/749024 employ CA Transform (a generic concept used for any CA work for several decades), the basic framework is radically different. This issue has been further elaborated under (2) noted below.

2. While the Patent 5677956 encrypts an input plain text as transform coefficients, the patent application 10/749024 encrypts a plain text element as the number of states traversed in a cycle (as the CA evolves). Thus the CA is employed in the application 10/749024 as a pattern matching tool resulting in minimal elapse time during decryption. This approach is radically different from that in 5677956 which employs traditional mathematical framework with CA as a transform tool to ensure that the residual error is zero after decryption. Obviously, both the schemes employ crypto-analysis of the underlying algorithm for protection against known attacks.

Hence, there is fundamental difference in Encryption between the applicant's patent and patent 5677956. The applicant could recommend names and contact information of scholars in this field with whom the examiner can consult for clarification in this matter.

Section VI: Difference between Integrated Operation ENCOMPRESSION (ENcryption + COMPRESSION) versus sequential execution of two operations Compression followed by Encryption

From the study of published literature - by convention, both Compression and Encryption operations are implemented employing different mathematical frameworks.

- Compression operation tries to identify redundancy in data elements employing different mathematical tools.
- Encryption operation incorporates transformations in plain text so that there exists no correlation/redundancy among data elements in cipher text.

Thus the basic framework of these two operations is totally different and any hardware/software implementation of these two operations are different and complimentary. Hence no integrated operation combining these two operations has ever been reported in the published literature. It is duly noted that there are separate patents of compression and encryption by Mr. Lafe (6546744 and 5677956).

An unique integrated operation - ENCOMPRESSION is claimed in the patent application 10/749024. The integrated operation is a single step operation which is different from a sequential and time consuming execution of Compression followed by Encryption which has been the traditional norm for decades.

The inventor of the Patent Application reports such an integrated operation ENCOMPRESSION for which no prior art is reported. This integration has been possible by use of CA (not for simulating traditional mathematical tools for compression and encryption), but as a pattern matching tool while implementing Vector Quantization scheme for compression, and employing

invertible CAs for encryption. The same hardware and software (PCA program), as reported in Fig. 1 (b) and (c) of the patent application, is used both for compression and encryption. Such an integration of two operations - Compression and Encryption - is not possible on employing conventional mathematical framework used by Patents 6546744 and 5677956.

1. The embodiment (presented in the pages 6 - 17 of the Patent Application) EnCompresses an input stream by generating code book indices that get encrypted. The concept of Programmable CA (PCA) - first proposed by the inventor in his book entitled "Additive Cellular Automata: Theory and Applications" (published by Wiley-IEEE Computer Society Press in July 1997, ISBN 978-0-8186-7717-5) has been utilized in this implementation so that the structure of PCA can be configured as different CA at different time steps of execution.

Note: The PCA Program (noted in the application) is not the traditional computer program. The PCA program specifies which CA will run for how many evolution steps at each program instruction. This PCA program is hence different from a traditional computer program.

2. This concept of PCA and associated PCA program has enabled the integration of two diverse operations - Compression and Encryption in the same hardware design reported in Fig. 1 (b) and (c). This integration is totally different from execution of two discrete operations with traditional use of a sequential computer program implementing Compression followed by Encryption operation.
3. The hardwired implementation noted in Fig 1 (b) is driven by the EnCompression program (explained above and elaborated in patent application pages 6 to 17) stored in memory (Item 28 in Fig. 1(b)). Similarly, implementation reported in Fig 1 (c) is driven by D'enCompression program stored in memory (Item 72 in Fig. 1 (c)). This embodiment is totally different from the traditional approach of storing conventional computer program in memory and executing compression followed by encryption employing traditional mathematical tools.
4. The integration of two operations Compression and Encryption in EnCompression reported in the patent application has become possible due to innovative use of CA technology as a Pattern Matching tool employing PCA (Programmable CA) and PCA program. The embodiment reported in pages 6 to 17 and Fig 1 provides the detailed framework of this integration.

Section VII : Response To Examiner's Point Nos. 8 to 18 in Respect of Claim Rejection 103 (pages 3 to 6).

Point No. 8: *"Claims 1-30 are rejected under 35 USC 103(a) as being unpatentable over Lafa US Patent No. 6456744 in view of Lafa'US Patent No. 5677956.*

Applicant's Response: The response on the underlying uniqueness of the applicant's patent described in Sections III - VI demonstrates that rejection of the claims is not justified.

1. Section III reports the fundamental difference between the applicant's patent application and Lafa's patents at a high level summary.
2. Section IV highlights the difference between Compression operation in Lafa's patent 6456744 and the compression task of ENCOMPRESSION reported in the application.
3. Section V enlists the difference between Encryption operation of Lafa's patent 5677956 and the Encryption task of ENCOMPRESSION reported in the application.
4. Finally, Section VI establishes that sequential execution of Compression followed by Encryption is totally different from the integrated operation ENCOMPRESSION reported in the applicant's application.

Point No. 9: *"As per claims 1, 11, 21 : Lafa discloses ----- . Therefore it would have been obvious to one ordinary in the art at the time the invention is made to modify the teaching*

methods of Lafe within Lafe method in order to applies a cellular automata (CA) transform for data encryption and decryption (see Lafe col 1 lines 53-55)."

Applicant's Response: The Section VI clearly spells out the difference between integrated operation ENCOMPRESSION (ENcryption + COMPRESSION) versus sequential execution of two operations - Compression followed by Encryption. This clarification points to the fact that the examiner's comment (noted with bold text under Point no. 9) is not valid and the approach taken in patent 10/749024 can never be derived from Lafe's approach in the wildest stretch of logical imagination. Sections III - VI highlight the differences between the Patent Application 10/749024 and two Lafe Patents 65467744 and 5677956. Applicant respectfully objects to the rejection of Claims 1-30.

Point No.10: As per claims 2,12, 22: the combination of Lafe and Lafe' disclose the method/system/logic encoded in media wherein compressing the vectors and encrypting the compressed vectors is a single integrated process implemented with a program executed on a Programmable CA (PCA) (See Lafe' col 1 lines 54-63, col 4 lines 50-65)."

Applicant's Response: As explained in Section IV, Lafe's scheme for compression employs Transform Coding generating transform coefficients which are stored in memory. **In the literature such coefficients are never referred to as Vectors** – by convention the term "vector" is used in Vector Quantization scheme of compression employed in the Patent Application 10/749024. Use of transforms and generating transform coefficient implies the compression operation. Hence examiner's comment (noted with bold letters under Point No. 10) "wherein compressing the vectors" **is totally inconsistent with Lafe's compression scheme**. Further, Lafe's encryption patent employs CA transforms to generate transform coefficients. Hence the question of using Programmable CA (PCA) (for **pattern matching** as proposed in the patent application 10/749024) is nowhere to be found in Lafe's schemes.

Consequently, examiner's comment "**encrypting the compressed vectors is a single integrated process implemented with a program executed on a Programmable CA (PCA) (See Lafe' col 1 lines 54-63, col 4 lines 50-65).**" is incorrect. With no amount of imagination, the text section referred to by the examiner in Lafe's patents can claim the use of Codebook and PCA. Further, as explained in Section VI, a sequential execution of compression followed by encryption (which is a conventional procedure) pointed by examiner is radically different from the integrated operation ENCOMPRESSION (Encryption + COMPRESSION) proposed in the patent application.

Hence the argument noted under Point 10 is strongly objected to by the applicant.

Point No.11: As per claims 3, 13, 23: the combination of Lafe -----generating codebook, the one or MACA operable -----(See Lafe col 5 lines 20-63 and col 6 lines 46-60)."

Applicant's Response: As explained in the response to Point no.10 and in Sections III, IV, and V, the very concept of **Codebook and MACA** referred to by the examiner under Point No.11 is nowhere to be found in Lafe's patents. With no amount of imagination, the text referred to by the examiner to Lafe's patents can claim the use of Codebook and MACA. Lafe's approach does not use even a remotely similar concept of a Codebook and MACA.

Point No. 12: As per claim 4.14, 24: the combination of Lafe' and Lafe' disclose -----storing the codebook using one of more MACA-based two class -----(see Lafe col 11, lines 38-57).

Applicant's Response: As explained in the response to Point no. 11 and in Sections III, IV, and V, the very concept of **Codebook and MACA** referred to by the examiner under Point No. 12 is not to be found anywhere in Lafe's patents. With no amount of imagination, the text referred to by the examiner to Lafe's patents can claim the use of Codebook and MACA.

Point No. 13: As per claims 5, 15, 25: the combination of and Lafe' disclose -----**compressing the vectors** -----one or more **MACA** -----(See Lafe col 5 lines 30-35, col 8 lines 29-48).

Applicant's Response: As explained in the response to Point Nos. 10-12 (noted above) and in Sections III, IV and V, the very concept of **Codebook, compressing the vectors** of a codebook, **MACA** referred to by the examiner under Point No. 13 is nowhere to be found in Lafe's patents. With no amount of imagination, the text referred to by the examiner to Lafe's patents can claim "compressing the vectors from the data stream using one or more MACAs deriving code book indices for the vectors." As highlighted before, Lafe's approach is different.

Point No. 14: As per claims 6, 16, 26 : the combination of Lafe and Lafe' disclose ----- encrypting the **compressed vectors** using multiple CA transforms -----use of one or more **linear CA, additive CA, and non-linear CA** configured in a **PCA** -----(See Lafe col 6 lines 32 through col 7 lines 65).

Applicant's Response: As explained in the response to Point Nos. 10-13 and in Sections III, IV, and V, the concepts of **compressed vectors** of a codebook, use of **linear CA, additive CA and non-linear CA, PCA** referred to by the examiner under Point No. 14 are nowhere to be found in Lafe's patents. With no amount of imagination, the text referred to by the examiner to Lafe's patents can claim "compressed vectors" of a Codebook and use linear CA, additive CA, non-linear CA as a PCA.

Point No. 15: As per claims 7, 17, 27 : the combination of Lafe and Lafe' disclose ----encrypting the **compressed vectors** using **four levels of CA transforms** (see Lafe col 6 lines 32 through col 7 lines 65).

Applicant's Response: As explained in the response to Point nos. 14 and in Sections III, IV, and V, the concepts of **compressed vectors** of a codebook and **four levels of CA transforms** referred to by the examiner under Point No. 15 are nowhere to be found in the detailed description in Lafe's patents. With no amount of imagination, the text referred to by the examiner to Lafe's patents can claim of "compressed vectors" of a Codebook and the use of four levels of CA transforms – linear, additive, non-linear in four levels.

Point No. 16: As per claims 8, 18, 28: the combination of Lafe and Lafe's disclosure ---- encrypting the **compressed vectors** using multiple CA transforms comprises using one or **more of linear transforms, affine transforms, and non-affine transforms** (See Lafe col 6 lines 32 through col 7 lines 65).

Applicant's Response: As explained in the response to Point Nos. 14-15 and in Sections III, IV, and V, the concepts of **compressed vectors** of a codebook, and the use of one or **more of linear transforms, affine transforms, and non-affine transforms** referred to by the examiner under Point No. 16 are nowhere to be found in Lafe's patents. With no amount of imagination, the text referred to by the examiner to Lafe's patents can claim the use of "compressed vectors" of a Codebook and the use of four levels of CA transforms using linear, additive, non-linear CA.

Point No. 17: As per claims 9, 19, 29: the combination of Lafe and Lafe' disclose ---- transmitting the **encompressed data** across communication link (See Lafe col 3 lines 47-50 and col 4 lines 29-53).

Applicant's Response: As explained in Sections IV – VI and reported under Section IV (c), the Lafe' patents generate transform co-efficients (employing traditional mathematical tools). Assuming sequential operation of Compression followed by Encryption as per Lafe's patents (that is not the same as the integrated single-step operation ENCOMPRESSION), the encrypted compressed coefficients (that are again some transform coefficients) are transmitted across the communication link. On the other hand the patent application 10/749024 transmits encrypted vector table indices (that are – the number of CA evolution steps as the CA evolves).

Consequently transmitted "data" over the communication link, as per Lafe's patents, refer to transform coefficients while in application 10/749024 it refers to number of CA evolution steps for efficient pattern matching.

Further, the word **Encompression** has been coined by the inventor of the patent application to refer to integrated operation ENCOMPRESSION (ENcryption + COMPRESSION) on the same hardware/software design. On sequential execution of Compression followed by Encryption, it should be referred to as "**Compressed THEN Encrypted**" data rather than "**Encompressed**" data, as claimed in the patent application.

Point No. 18: As per claim 10, 20, 30: the combination of Lafe and Lafe' disclose --- decrypting the transmitted encompressed data using multiple CA transforms (See Lafe col 9 lines 14-35 and col 11 lines 50-67).

Applicant's Response: As explained in the response for Point No. 17, the word Encompression has been coined by the inventor of the patent application to refer to integrated operation ENCOMPRESSION (Encryption + COMPRESSION). On sequential execution of compression followed by encryption, it should be referred to as "Compressed THEN Encrypted" data rather than EnCompressed data claimed in the patent application. In the patent application 10/749,024, D'enCompresesion of EnCompressed data occurs by employing multiple CAs as the pattern matching tool. By contrast, the decryption and decompression (as two separate sequential steps) in Lafe's patent employs CA as traditional mathematical tool to derive reverse transform.

The very application of CA as a pattern matching tools, as reported in the patent application 10/749024, is totally different from the use of CA in Lafe's patents as traditional mathematical tool for generating transform coefficients.

Conclusion

Applicant clearly outlines the salient differences in scope and approach between the applicant's patent application 10/749,024 and Patents 6,456,744 and 5677956. In sections III – VI of this response, the applicant highlights in a conscientious way the fundamental and as well as the detailed differences between the two radical opposite approaches taken by the inventor and Mr. Lefe. It is with some degree of concern that the inventor notes the generic remarks by the examiner in rejecting the claims, sighting specific sections from Lefe's patents with absolutely no relation with the claims registered under patent application 10/749,024.

The inventor and applicant of patent 10/749,024 is a well renowned researcher in the area of Cellular Automata for over 30 years and published several 100 academic papers and books. To aid the examiner in understanding of such a complex subject like Cellular Automata (CA), Section III - VI has been provided. The applicant could also recommend to the examiner names and contact information of several leading scholars and researchers both in academia and industry, in the field of compression, encryption and Cellular Automata in USA and Worldwide with whom the examiner could consult for any clarifications.

The Applicant respectfully requests an early and favorable action in his case.

If the Examiner believes a telephone conference would clarify details to accelerate action on this case in any way, the Examiner is invited to contact Mr. Somshubhro Pal Choudhury, the Agent for the applicant, Prof Parimal Pal Chaudhuri at 408-910-2936.

Respectfully submitted,



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